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AUTHOR Bond, Jack H.
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ABSTRACT

A scale was developed for judging the relative value of various media in teaching children. Posttest scores were partitioned into several components: error, prior knowledge, guessing, and gain from the learning exercise. By estimating the amounts of prior knowledge, guessing, and error, and then subtracting these from the total score, an index of effectiveness emerges. The resulting index has been applied as a selection criterion for multiple choice questions generated to measure objectives of instructional films. The index figure for each question was used to assign or verify assignment of grade, age, and achievement levels for the question. A high learning index value indicated a good match between question, media, and respondent. An average of these positive question index values then serves as an index of a given medium's effectiveness. The indexes from several media on the same subject matter would allow some comparison. Adding the results of observed attention spans, vocabulary levels, curriculum classes, and subject descriptors to the index value provides a profile of a given medium. This profile can then serve to indicate the medium's suitability for a given child, a given content unit, or a given level of skill development. (Author/JK)

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AN EFFECTIVENESS INDEX AND PROFILE FOR INSTRUCTIONAL MEDIA *

JACK H. BOND

COMPUTER BASED PROJECT **

No basis for comparing the many facets of media seems to exist. It would seem logical to assume that a given media does possess attributes that do influence the behavior of those upon whom it is used in much the same way that a curriculum influences the behavior of children subjected to it. If an achievement test can be conceived as measuring the behavior of a child as given curriculum progresses, why not an "achievement" test for a media that measures attributes as to their degree of influencing or desired (or designated) behaviors?

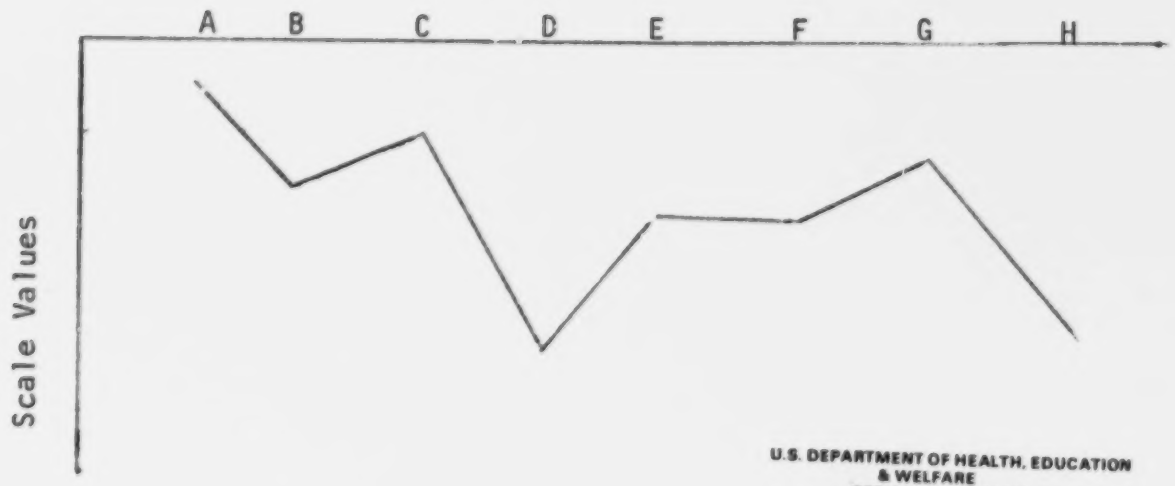

FIGURE I

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The attributes across the top would consist of groupings of given variables that can be qualified and reduced to a standard score, percentage, etc.

For the sake of discussion let's arbitrarily label some of these to propose what "behavior" a given media might exhibit. "A" could be a time length, "B" might represent the content variable or attribute quantifie as a scalar value in relation to the total content information desired from a curriculum. "C" might be a vocabulary attribute quantified by comparing to a standard vocabulary list. "D" a grade level from a given curricular guide of specification. "E" could be an attention factor the degree to which viewers are distracted from its major purpose, and so on.

It is not the purpose here to get into the details of measurement but rather to simply say it can be done once the attributes have been assigned as important decision factors for a film or other media. Such a profile would seem to require specification of the curricular setting in a slightly different way than just naming the subject area topics or units a media might fit. The above attributes have already been specified for some aspects of media - - A-V catalogues have specified subject area covered, media level as E-JH-H-C etc., length, etc. Classifying on several other variables as completeness of subject coverage, attitude, discussion evoked, attention, achievement gain, effect on subject, etc., could also be assigned in much the same way Osgood determines attitude using the sematic. The scale value becomes an average of these classifications. Experts look at a media and decide on a number of classifications already. The variable that really hasn's been noted is the learner effects. These judgements need to be quantified so that one may select a media because it is "high" in attitudial effect, high in attention, "high" in vocabulary or "low" in distonance in much the same way a book might be selected for a child because he had a given achievement profile. Preciseness of the measurement (or assignment) would be rough at first because the media profile requires looking at the use of a given media in a more precise way than its title and grade level classification from the A-V catalogue. But as the generation of Indexes procedes and profiles are produced, specification becomes more precise because the methodology of classification begins to "factor out" what is really being measured.

Let's proceed to develop the data to produce a proto type profile. First, we plot the media length as the first index. This index could use minutes as the unit. For films, and audio tapes (or similar exact time media) the running time is rather easy to measure. For variable time media like filmstrips, overhead transparencies, programmed texts, manipulative materials, an average time can be indicated.

Second, we plot a grade level assignment. This can be a rather gross measure taken from a number of media center catalogues or more precisely determined from trials with various sample grade groups to get greatest response. Subjective grade classification could also be done by comparing media content with graded curriculum guides and/or text books and assigning the resulting grade level.

The vocabulary level index depends on an established hierarchical list of common vocabulary. As a test of this index we used the Stanwix House list and decision level of 90%, stating that if 90% of the words for a given grade level are used in the captions or audio track, it is given this level. Several alternatives suggest themselves such as, 1) creating a hierarchy of vocabulary for given prpulations - - mentally retarded, already done, inner-city, urban, etc., and submitting an index for each; 2) establishing the percentage

level at a point of "break even" rather than an arbitrary point such as 90%.

The skill level index is determined by classification of the media major or basic skill concept. This concept reflects the effect on the user or the skill he must use. Of the taxonomies available, we found two most applicable to our preliminary efforts - - Social Learning Curriculum (Yeshiva) and Meeker's Structure of the intellect (1969).

An achievement gain index would reflect the objectives. Several complications of objectives are available, i.e., Westinghouse, Stanford, and Computer Based Resource Units. These need to be organized into hierarchies or other scaler order.

An Attention index is determined from observing viewing audiences and reducing the observation to a numeric value. An attitudinal index - might rate a proneness for a given media.

Now let's look at how we might determine some of these indexes.

The Skill Index is related to a curriculum hierarch or to a skill hierarchy. The SOI serves this function for us.

Meekers SOI has three areas of learner performance and a hierarchy with each area. We class the test items by what is required of the learner and use a majority rule for the film class. You will see this later. For example, if the item is a recall of a fact - Memory under operations if fact is a word-Semantic under Contents and if fact is chosing between like items - Classes under Products - If the majority of the items have MM class, the media has this class.

The Social Learning Curriculum is a related hierarchy of subject matter defined to produce given student behaviors - psychological, social, and physical with sub-classes in each. A hierarchy is established using an expanding environment concept - Self, Home, School, etc., Professional judgement gives assignment. This doesn't fit profile yet.

The Achievement Index is a gain index which must answer the question of meaning when used to indicate "benefit", "effectiveness", or "success." Two views of the data obtained from a pretest - posttest situation, i.e., a score-for a given subject across items and the score for items across subjects. Both come from the same data and could be perceived as containing similar components only viewed from a different perspective. Assume that a criterion test or question score is made up of several factorable components as indicated:

Posttest Score	=	Effect of Learning Exercise	+	Guessing	+	Prior Knowledge	+	Error

If estimates of these components are obtained, the true learning effect value for subjects of a given experience might become an index for comparison with other levels of respondents, and the value for item, an index for appropriateness of an item. The prior knowledge component could be estimated by a pretest. The estimate for guessing can be statistically determined as a ratio based on the number of known (given) response choices and the number accepted as correct.

Thusly, from a population we have estimates for the Posttest score, the guessing component, and the prior knowledge component. Subtracting these component estimates from the Posttest score leaves the effects of learning and error. If we look at the error component we see that its effect is probably one of depressing the Posttest score from a perfect measure an taking from the learning effect component; for example, if the test items measure exactly the desired information, a higher Posttest score would result and a higher learning effect would also result. As a result of eliminating error factors higher learning indexes would result.

The important aspect of the gain index is that a positive value does emerge after controlling for quessing and prior knowledge. Under present situations of obtaining information, the index would be perceived as indicating a minimal effectiveness of media or a test item.

The Posttest score for an item has been applied as a selection criteria for multiple choice items generated to measure objectives of instructional films. Estimates of item guessing and prior knowledge effects are subtracted from the Posttest score for the item resulting in an index of gain or learning as measured by the item. A negative index indicates error factors in the question causing polarization on a response choice that is not judged the correct choice.

In Figure II, is indicated the output analysis for a film test in a sample classroom. The codes are: C, correct on pretest and posttest; S, gain; E, negative gain; W, same wrong choice on pretest and posttest; Z, change in wrong choice.

	TOTALS					TEST ITEMS									
STU#	C	S	E	W	Z	1	2	3	4	5	6	7	8	9	10
201	2	1	2	4	1	w	e	z	s	c	e	w	c	w	w
202	3		2	4	1	w	c	w	c	c	z	w	e	e	w
203	1	4	3		2	e	e	z	z	e	s	s	c	s	s
205	4	2	1	2	1	w	c	s	w	c	sz	z	e	c	c
206	2	3	1	1	3	s	c	w	c	s	z	z	c	s	z
207	4	4	1	1		s	c	c	s	c	s	w	c	s	e
208	6	4				s	c	s	s	c	c	s	c	c	c
211	3	2		4	1	s	c	w	s	c	z	w	c	w	w
212	3	1	1	3	2	z	e	w	w	c	c	w	c	w	z
215	4	1	2	1	2	z	e	c	s	c	c	w	e	z	c
216	1	3	4		2	z	e	e	s	s	s	z	e	e	c
					TOTALS c	0	6	2	2	8	3	0	6	2	4
					TOTALS s	4		2	6	2	4	3		3	1
					TOTALS e	1	5	1		1	1		5	2	1
					TOTALS w	3		4	2			5		3	3
					TOTALS z	3		2	1		3	3		1	2
					Pretest %	9	100	27	18	82	36		100	36	45
					Posttest %	36	55	36	73	91	64	27	55	45	5
					Gain	±		±	±	±	±	±		±	
					s-e	3	-5	1	6	1	3	3	-5	1	0

FIGURE II

Note that the 33 "C" responses indicating about one third of the information is already known by this group. Also note (first overlay) that these responses are essentially from three items 2,5, and 8. An interesting side is that these items introduced most of the error.

Note that the gain (s) are evenly distributed across other items.

The complete rationale and explanation of the prepost analysis is a subject for another presentation, but sufficient to say here that this media has an index of 26 for this population.

A second use of the gain index for the item would be verifying the assignment of grade, age, or chievement levels for the media. A high prior knowledge "C" score indicates media simplicity in terms of the responding population, i.e. #8 where as a high learning index "S" indicates a good match between question - media - respondent, i.e., #4. An average of the positive item index values could serve as an index of a given media's effectiveness using the set as the i strument i.e., 26 indicates one can expect learning to result. The indexes from several media on the same subject matter would allow some comparison (similar to judging academic achievement between two children given their achievement scores.) The value of the effectiveness index could indicate a degree of suitability by percentage points for a given level of child, a given content unit, or a given level of skill development.

The attention index is obtained from an adaptation of the observational procedure devised by Palmer (1968) at Sesame Street. These observations are made by recording the frequency of subjects at 10 second intervals who have eyes fixated on the media. These data are compiled into observation graphs of attention behavior. See Figure III.

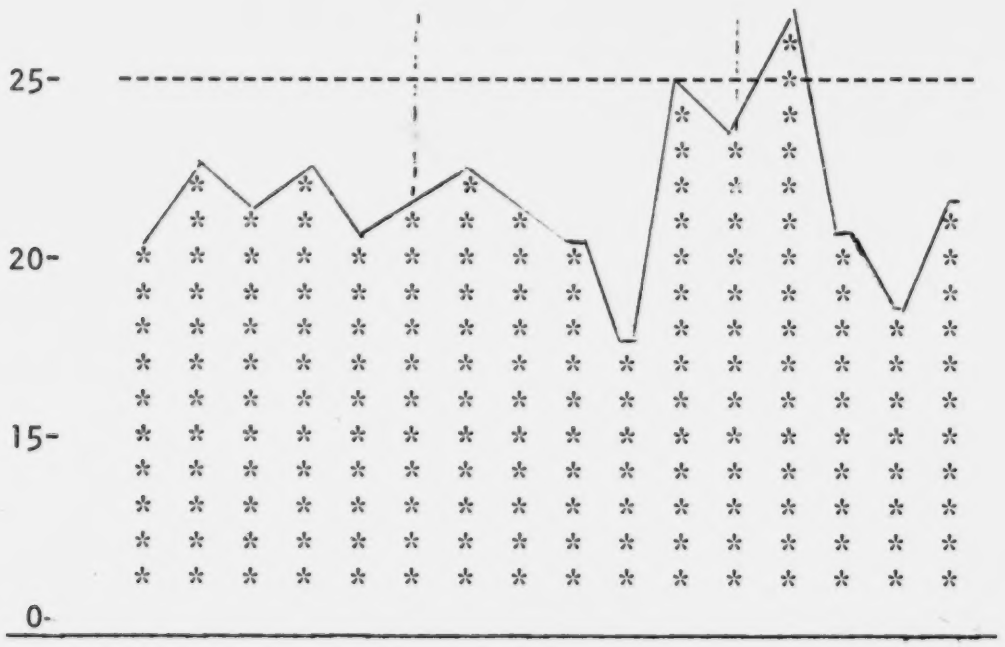

FIGURE III

1 2 3

A value derived from these graphs serves as an index by using a criteria as the percent of time in which a specified proportion of the audience is "watching" i.e., 90%. Thus, a value of 75 would mean that 90% of the audience attended 75% of the time the media was used. Note profile of 5 media and resulting index - as shown in Figure III.

Compiling these indexes into a profile for a media would give a descriptive digest of the media and its apparent effectiveness.

Media	Length	Vocabulary Level	Skill Level	Achievement Level	Attention Percent	Attention Index
1366	7.7	4.	3±	MFR	20	00
2022	11.0	5.	3±	MSU	20	20
1092	10.2	2.	3	EMR	--	21
1066	10.5	2.	3	MSR	60	91
1039	9.1	6.	7±	MMC	10	4

This profile can serve as a description of the media, to indicate the suitability for a given child, content unit, skill development, etc. Through the profile, one media could be contrasted against another to ascertain differences and similarities in media effects. They could be used to develop various learner skill areas independent of content areas. In fact the possibilities become almost endless as one considers situations.

The implications of creating the profile would lead away from the present sctivity of professional opinion to evaluate and state the apparent usefulness of a media, to a situation where the media is actually subjected to learners to determine the effectiveness of media. This demand will require more specific detailing of curricula, objectives, test items, etc.

A second implication is that we can begin to look at media in terms of what it does rather than its form. If lecturing sequences have low attention value, as Palmer found, these techniques would be inappropriate for high attention situation. Objectives and conditions become parameters for the production of media to meet these conditions rather than justifying a media existance or use after it is produced.

The implications as to the relationships of variables in media to student characteristics training situations, etc. are almost endless.

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Number of Subjects
10
15
20
25
Running Time In Minutes
1-
2-
3-
4-
5-
6-
7-
8-
9-
10-
11-
12-
Which plane would be the simplest to build?
What is the horsepower of today's planes?
Have the basic principles of getting a plane into the air changed in 50 years?
Are planes faster than any bird?
When is the efficiency at a propeller plane highest?
What is the fastest a propeller plane can fly?
Where was jet propulsion first used?
How is propeller plane inefficiency overcome?
When was jet propulsion first used?
What is Newton's third law?
What happens when air rushes out of a balloon?
The air moving out the balloons neck is the action.
What is the reaction?
A man throws a bowling ball into the pins. What is the reaction?
A man shoots a shotgun. What is the reaction?
What moves the model cars that operate on capsules?
What part of a jet keeps up internal gas pressure?
Where does air come into the jet engine?
What happens in the burners of a jet?
When gases are forced out the rear of a jet?
What are the accessories?
Which plane has the most cockpit controls?
Which plane has the smallest amount of vibration?
Which plane is kept light as possible for more horsepower?
Which plane is most efficient under 400 miles per hr?
Which aircraft uses the most fuel?
Jets are best.
When does a jet have highest efficiency?
Which jet has intermittent firing?
Which type of plane needs the most fuel?
How fast do jets go?